

## PATENT

Atty Docket No.: 200205522-1  
App. Ser. No.: 10/675,944

**IN THE CLAIMS:**

*Please find a listing of the claims below, with the statuses of the claims shown in parentheses. This listing will replace all prior versions, and listings, of claims in the present application.*

1. (Currently amended) An apparatus for speeding up Retinex-type processing of an input image, comprising:

a down-sampling module configured to produce one or more sub-sampled images of the input image;

a non-linear illumination estimation module that receives the sub-sampled images and produces corresponding interim illumination estimations;

an up-sampling module configured to receive the input image and to interpolate the interim illumination estimations to produce an illumination estimation by using the input image as a guide in the interpolation, and wherein the illumination estimation is usable to perform a Retinex-type correction to the input image;-and

~~an illumination manipulation module configured to combine the input image and the illumination estimation to produce an output image.~~

2. (Previously Presented) The apparatus of claim 1, wherein the up-sampling module is configured to implement an interpolation routine that receives the interim illumination estimations and a sampling rate, and produces the illumination estimation.

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3. (Previously Presented) The apparatus of claim 2, wherein the up-sampling module is further configured to enforce an envelope constraint.

4. (Currently amended) The apparatus of claim 1, wherein the up-sampling module is further configured to receive the difference of the sub-sampled images and the interim illumination estimations, and a sampling rate and to produce ~~[[the]]~~an interpolated difference; and

wherein the up-sampling module is further configured to add the interpolated difference and the input image.

5. (Currently amended) The apparatus of claim 1, wherein the up-sampling module is further configured to produce a difference-interpolated illumination estimation, to produce an illumination-interpolated illumination estimation, and

to average the illumination-interpolated illumination estimation and the difference-interpolated illumination~~[[s]]~~ estimation to produce the illumination estimation.

6. (Previously Presented) The apparatus of claim 5, wherein the up-sampling module is further configured to apply a difference weight to the difference-interpolated illumination estimation and to apply an illumination weight to the illumination-interpolated illumination estimation.

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7. (Original) The apparatus of claim 6, wherein the difference weight and the illumination weight change from location to location in the image such that for every location the difference weight and the illumination weight sum up to 1.

8. (Original) The apparatus of claim 6, wherein the difference weight and the illumination weight each equal 0.5.

9. (Previously Presented) The apparatus of claim 1, wherein the up-sampling module is further configured to implement an interpolation cascade,

said interpolation cascade being configured to perform a difference interpolation and an illumination interpolation.

10. (Previously Presented) The apparatus of claim 9, wherein the up-sampling module is further configured to perform the illumination interpolation following the difference interpolation.

11. (Previously Presented) The apparatus of claim 9, wherein the up-sampling module is further configured to calculate a difference interpolation rate  $R_D$ , an illumination interpolation rate  $R_I$ , and an overall interpolation rate  $R_O$ , and wherein the interpolation rates  $R_D$ ,  $R_I$ ,  $R_O$  change from location to location in the image.

12. (Original) The apparatus of claim 11, wherein for every location in the image the interpolation rates  $R_D$ ,  $R_I$  and  $R_O$  obey  $R_D * R_I = R_O$ .

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13. (Canceled).

14. (Currently amended) A method for speeding up Retinex processing of a high resolution input image, comprising:

producing one or more low resolution input images by sub-sampling the high resolution input image;

generating an interim illumination estimation for each of the one or more low resolution input images;

generating an illumination estimation suitable for Retinex-type correction by up-sampling the interim illumination estimations, wherein generating the illumination estimation comprises combining the input image and the interim illumination estimations; and

producing a Retinex-corrected output by ~~combining from the combined~~ input image and the illumination estimation.

15. (Previously Presented) The method of claim 14, wherein generating an illumination estimation further comprises:

receiving the interim illumination estimations and a sampling rate to produce the illumination estimation; and

enforcing an envelope requirement by applying a local maximum routine.

16. (Currently amended) The method of claim 14, wherein generating an illumination estimation by up-sampling the interim illumination estimations further comprises:

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subtracting the one or more low resolution images and the interim illumination estimations to obtain difference images;

receiving the difference images and a sampling rate;

~~producing the illumination estimation;~~ and

adding the illumination estimation and the input image.

17. (Currently amended) The method of claim 14, wherein generating an illumination estimation by up-sampling the interim illumination estimations further comprises:

producing a difference interpolated illumination estimation ~~by applying a difference interpolation algorithm~~ to the interim illumination estimations;

producing an illumination interpolated illumination estimation ~~by applying an illumination interpolation algorithm;~~ and

wherein generating the illumination estimation further comprises averaging the illumination interpolated illumination estimation and the difference interpolated illumination estimation.

18. (Previously Presented) The method of claim 17, wherein generating the illumination estimation further comprises:

applying a difference interpolation weighting factor to the difference interpolated illumination estimation; and

applying an illumination interpolation weighting factor to the illumination interpolated illumination estimation.

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19. (Original) The method of claim 18, wherein the difference interpolation weighting factor and the illumination interpolation weighting factor sum to 1.

20. (Currently amended) The method of claim 14, wherein generating the illumination estimation further comprises:

implementing a difference interpolation module; and

applying an illumination interpolation weighting factor module.

21. (Canceled).

22. (Previously Presented) A method for speeding up Retinex processing of an image, comprising:

producing low resolution images by sub-sampling the image;

generating an interim illumination estimation for each of the low resolution images;

producing a difference interpolated illumination estimation by implementing a

difference interpolation module on the interim illumination estimations;

producing an illumination interpolated illumination estimation by implementing an illumination interpolation module; and

averaging the illumination interpolated illumination estimation and the difference interpolated illumination estimation to produce the illumination estimation.

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23. (New) The apparatus of claim 1, further comprising an illumination manipulation module, wherein the input image and the illumination estimation are combined to produce an output image.